UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

FINAL REPORT ON THE INDEPENDENCE CREEK EXPERIMENTAL CONTROL PROJECT COEUR D'ALENE NATIONAL FOREST.

by

James C. Evenden
Associate Entomologist

1926 April 6, 1927

FINAL REPORT ON THE INDEPENDENCE CREEK EXPERIMENTAL CONTROL PROJECT

COEUR D'ALENE NATIONAL FOREST

- - - - -

INDEX

	Page
INTRODUCTION	1
DESCRIPTION OF THE AREA	2
HISTORY OF INFESTATION	3
CONTROL WORK	5
METHODS OF DETERMINING RESULTS OF CONTROL WORK	8
RESULTS OF INDEPENDENCE CREEK CONTROL WORK	12
JUSTIFICATION OF EXPENDITURE FOR CONTROL	14
SUMMARY	17
CONCLUSIONS	18

FINAL REPORT ON THE INDEPENDENCE CREEK EXPERIMENTAL CONTROL PROJECT

COEUR D'ALENE NATIONAL FOREST

- - - - - - - -

INTRODUCTION

In 1919 the head waters of the Independence Creek Drainage was selected as an experimental area for the purpose of instituting an intensive study of mountain pine beetle attacks in white pine. This region was selected for this study as it offered an area of workable size which was as near isolated from outside influences as could be found.

Though an intensive outline for this study was prepared it was found impossible to conduct the work as planned and from 1919 to 1923 inclusive, the work consisted of recording each year the annual loss due to mountain pine beetle attacks. In 1924 the plan of this experiment was changed to a test of our present methods of control against a so called normal infestation of the mountain pine beetle in white pine. The importance of the losses occurring from epidemics of this insect where the red top trees may be seen in large groups throughout an area is readily recognized. However the insidious losses resulting from what is called a normal or endemic infestation are usually overlooked by the forester or timber owner who does not recognize the work of forest insects as causing

the death of the many trees scattered rather regularly throughout the area. These losses, though perhaps small for any one year, amount to a rather startling figure when taken over a period of time. To answer the question, "Will the present stumpage value of white pine support the control of endemic or normal infestations of the mountain pine beetle?", it was decided to institute control measures within this area for a period of five years. This region seemed especially adapted to this experiment as data relative to the volume of timber killed during the past six years was available and it was reasonably free from outside influences. The work was started in 1924 and continued during the seasons of 1925 and 1926. Unfortunately during the summer of 1926 the region was swept by a severe forest fire which made the continuation of this experiment impossible. This occurrence is extremely regrettable as it is sincerely believed that following the control work of 1926 the small loss which followed the 1925 operation would have been maintained if not further reduced. Though the results of only two year's control work are available an attempt will be made to analyze the data secured from the experiment.

DESCRIPTION OF THE AREA

The area selected for this experimental study was the timbered portion of the Independence Creek drainage on the head waters of the Coeur d'Alene River which for the most part is located in T. 53 N. R. 1 W., B.M. The total white pine acreage

of this area, which included Snow and North Creeks, is about 3,500 acres. Though the timbered acreage was much larger than the above figure only the white pine type is considered in this report.

The forest cover is an uneven white pine stand varying from 100 to 250 years in age. Of this cover there is approximately 40 percent white pine or about 8,517,000 B.F., the remainder being larch, Douglas fir, spruce and white fir. Most of the timber on the upper slopes was of a species other than white pine and was not considered in this problem.

There are perhaps some 500 acres of flat bottom land along the creek which is of a deep black loam soil. The remainder of the area lies on slopes varying from 30 to 60 degrees in steepness with a rather smooth surface free from rocks. The soil on these slopes is a fine red clay loam.

Except for a narrow belt of timber at the extreme southern portion this area was fairly well isolated from other bodies of white pine timber by the 1910 and older burns. However, regardless of the slight connection which this area has with other bodies of white pine it is believed that the degree of isolation would eliminate practically all outside influences.

HISTORY OF INFESTATION

In 1912 and 1913 a severe epidemic of the mountain pine beetle occurred throughout the white pine stands of Northern Idaho. In 1913 Mr. S. Kolvera, who at that time was in charge of forest insect

control work within District One, reported that there were large numbers of red-topped white pine in the Independence Creek area. At the time of the writer's first visit to this region in 1919 the evidence of this epidemic was still plentiful. Large groups of dead trees were to be seen throughout the region but more especially along the creek bottoms where the heavier stands existed. Since that time no serious epidemic has occurred in this region, however, there has been an annual loss averaging from one-half to one per-cent of the total white pine volume of the area. The losses from 1918 to 1923 inclusive, resulting from the attacks of the mountain pine beetle are given in the following table. However, as the 1918 loss was not recorded until the season of 1920 there is no doubt but that the volume as shown in this table is considerably lower than it should actually be.

Table No. 1.

Table Showing the Volume of White Pine Killed by the Mountain Pine Beetle on Independence Creek from 1918 to 1919 Inclusive.

Year of Attack	Number of Trees Killed	Average D. B. H.	Average Volume per Tree	Total Volume Killed Each Year B. F.	Percent of Increase or Decrease in Volume Killed.	Departure from the Average Volume Killed for 6 year Period. B. F.	Percent of Total Stand Killed.	
1918	16	27.4	1365	21840	--	-29.613	.0026	.26
1919	78	22.2	755	58915	+1.6975	+ 7.462	.0069	.69
1920	101	24.9	1164	117575	+ .9956	+66.122	.0138	1.38
1921	30	26.3	1284	38550	- .6721	-12.903	.0045	.45
1922	22	24.2	1051	23140	- .3997	-28.313	.0027	.27
1923	34	27.2	1432	48700	+1.1045	- 2.753	.0057	.57
Average		25.3	1175	51453			Total .0362	3.62

CONTROL WORK

Control measures were instituted in the Independence Creek region in 1924 and again in 1925 and 1926. Infested trees were located by the discolored foliage. This method is not entirely satisfactory as a certain percent of the trees are bound to be overlooked. However for this experiment which called for the testing of our present methods of control against normal infestations of the mountain pine beetle, it was believed that a 100 percent survey of the area would not have been justified and that the location of the trees by the discolored foliage would be the method followed in actual practice. Advantage was taken of ridges, rock out-croppings, open parks, etc., in order to secure views of the different portions of the regions, and it is believed that fully 90 percent of the infested trees were located and treated. Furthermore, this was the method that had previously been used in recording the yearly loss. The spotting of infested white pine trees by the discolored foliage is very confusing as all degrees of foliage fading will be found. It is practically necessary to examine all trees which have any discolored needles remaining as often heavy broods are found in what appear to be insect abandoned trees.

The method of treatment consisted of felling the trees and peeling the bark from the infested portion of the trunk. Axes and peeling spuds were used in this work. The trees were not bucked except when necessary to roll the trunk in order to peel the under side. As the entire development of the insect occurs directly between the bark and the wood the exposure resulting from the removal

of the bark while the broods are in a larval or pupal stage is sufficient to destroy them.

In 1924 and 1925 the trees were very heavily infested. The attacks extended in most cases to a five or six inch top and on the lower portion of the bole the broods varied in numbers from two hundred to three hundred larvae and pupae per square foot of bark surface. In 1926 the attacks were a great deal lighter and seldom extended above a twelve inch top. The broods were very much lighter varying from fifty to one hundred and fifty larvae and pupae per square foot as an extreme maximum. The heavily infested trees peeled very easily, it being possible to knock off large flakes of bark several square feet in area from the lower portion of the bole. On the other hand the lightly infested trees peeled very hard and it was often necessary to practically chop the infested bark from the trunk.

Table No. 2.

Table Showing Volume Treated During the Three Years of Control.

Year of Attack	Year Treated	Number of Trees	Average D. B. H.	Average Volume Per Tree	Total Volume Treated	Change Over Previous Year's Loss in Percent.
1923	1924	34	27.24"	1432.3	48.700	+1.1045
1924	1925	19	22.53"	998.9	18.980	- .6102
1925	1926	7	22.57"	833.6	5.835	- .6925

Table No. 3

Cost of Control Work for the Years 1924, 1925 and 1926.

Items	1924	1925	1926
Labor			
Noneffective (x)	65.00	24.00	16.00
Effective (xx)	85.00	69.00	59.00
Subsistence	54.95	24.15	23.45
Packing	4.75	18.99	20.52
Travel	16.16	4.29	7.50
Overhead	25.00	---	---
Equipment	---	4.50	2.10
Totals	254.89	144.93	128.57

(x) Includes travel time to and from the project, and cooks' wages for 1924.
(xx) Actual productive crew days including daily walking time.

Table No. 4

Summary of Control Costs.

Items	1924	1925	1926
Total Cost of Project	$254.89	$144.93	$128.57
Total Volume Treated B. F.	48700	18.980	5.835
Number of Trees Treated	34	19	7
Total Cost per M. B. F. Treated	$5.23	$7.63	$22.03
Total Cost per Tree Treated	$7.49	$7.63	$18.37
Cost per Man Day (Wages $4.00 - Subsistence $1.05)	$5.05	$5.05	$5.05
Number of Effect Man Days	21¼	17⅛	14⅝
Cost per M. B. F., Actual Labor Only	$1.74	$3.63	$10.11
Cost per Tree, Actual Labor Only	$2.50	$3.63	$8.43
M. B. F. Treated per Effective Man Day	2.292	1.100	395
Trees Treated per Effective Man Day	1.6	1.1	.474
Cost for Subsistence per Man Day (x)	$1.05	$1.05	$1.05
Cost per M. B. F., Actual Labor and Subsistence.	$2.29	$4.58	$12.76
Cost per Tree Actual Labor and Subsistence	$3.15	$4.58	$10.64
Total Cost per A (3,500 A)	$.0738	$.0414	$.0367
Cost per A, Actual Labor and Subsistence	$.03	$.0248	$.0212

(x) Actual cost of subsistence was computed at 35¢ per meal as there was a refund of supplies purchased.

METHODS OF DETERMINING RESULTS OF CONTROL WORK

Analyzing the actual results obtained from forest insect control projects is a difficult problem. If data were available as to what the loss would have been had no control measures been instituted then the task would be a relatively simple one. It is evident that the results should be based upon the value of the timber saved rather than on the cost of the project, and the volume treated.

From the table (No. 1) on page 4 and Chart No. 1 it will be seen that the infestation passed from a low point in 1918 to a high one in 1920, and back to a low, corresponding to the 1918 loss, in 1922. Though it is recognized that insufficient data is available to establish the fact of a four year's cycle of infestation for this region, it is very evident that from 1918 to 1921 inclusive, the infestation did pass through such a cycle. Furthermore it can be assumed from the 1922 and 1923 losses that the infestation had started to increase again. This fact is rather substantiated by the extremely heavy attacks and broods of the 1923 attacked trees. Furthermore it is recognized that with the limited amount of data available it will also be difficult to set up an annual loss for this area over a period of years greater than that for which actual data is available. This is especially true as the four or five years prior to 1918 would include a year or two of the severe epidemic which occurred at that time. Therefore in order to analyze the results obtained from this project it will be necessary to base all conclusions upon the limited amount of data available.

Table No. 5

Table Showing the Volume of Timber Killed by the 1923, 1924 and 1925 Attacks, the Percentages of Reduction Over Previous Year's Loss, etc.

Year of Attack	Year Treated	Volume Killed B. F.	Change Over Previous Year's Loss. Volume	Change Over Previous Year's Loss. Percent	Departure From Average of Six Years. Volume	Departure From Average of Six Years. Percent	Percent of Total Volume Killed.
1923	1924	48,700	+25.560	+1.1045	-2.753	-.0535	.0057
1924	1925	18,980	-29,720	- .6102	-32.473	-.6311	.0022
1925	1926	5,835	-13,140	- .6925	-45.618	-.8865	.0006

From Table No. 5 one notes that a reduction over the previous year's loss of .6102 percent or a saving of 29,720 B.F. followed the 1924 and a reduction of .6925 percent or 13,140 B.F. the 1925 control operations. If we are obliged to depend upon this method for the determination of results, which is perhaps the only physical evidence, the answer would be as shown in the following tabulation.

Year	Volume Treated	Reduction	Cost of Project	Cost per M.B.F. Saved.
1924	48,700	29,720	$254.89	$8.58
1925	18,980	13,140	$144.93	$11.03
		Average Cost		$ 9.80

To attempt to determine the results of a project by the above method would be even more than problematical. In most cases the results secured would be in reverse to those as shown. As an example control measures instituted at the peak of an epidemic would no doubt show a tremendous reduction over the previous year's loss. This would

seem to justify the expense of the operation and the project would undoubtedly be called a success, when actually a very large percent of the reduction would have been the result of natural agencies alone. On the other hand control work instituted at the time an epidemic was increasing would not show a great reduction over the previous year's loss. Such a result would show the project to be a failure when undoubtedly the control work instituted was directly responsible for a marked reduction in the epidemic which would more than justify the expense of the operation. This latter case is undoubtedly what happened on the Independence Creek Project in 1924.

Another method just as uncertain as the above lies in the prophesying of the possible course of the infestation had no control work been instituted. In this connection and for the sake of computing possibilities it can be assumed that had no control measures been instituted the cycle of infestation which occurred from 1918 to 1921 would have repeated itself. This can easily be imagined from studying the losses as shown on Chart No. 1. Under this assumption we would have the following volume of timber killed by the 1924 and 1925 attacks had no control work been instituted, with the volume of timber saved as a result of control work.

Volume of Timber Killed by 1924 and 1925 Attacks Under the Assumption that the 1918 - 1921 Cycle would Have Repeated Itself.

Year of Attack	Assumed Volume	Actual Volume Killed After Control Work.	Volume Saved	Assumed Cost per M.B.F. Saved.
1924	117,575	18,980	98,598	$2.58
1925	38,550	5,835	32,715	$4.43
			Average Cost	$3.50

Under the first method we would show a saving of 42,860 B.F. as a result of the 1924 and 1925 control operations at an average cost of $9.80 per M.B.F. saved. Under the second method a saving of 131,310 B.F. would be saved at an average cost of $3.50 per M. B.F. These two methods show a difference in the amount of timber saved of 88,450 B.F., and $6.30 in the average cost per M.B.F. saved.

The second method gives very gratifying results, however, they are derived from assumed and decidedly inaccurate data based upon very uncertain prophesies. Though such data are nice to juggle they are of no value whatever for one is dealing with the prophesy of natural life which can seldom be accurately determined. It is felt that as both of these methods are so uncertain they should be disregarded in an attempt to determine the actual results of this project.

It would seem that the only fair way of answering this question would be to set up an annual average loss for the region in question to which the reinfestation following control work could be compared. This can be secured by following the infestation for a few years prior to the institution of control measures or from an intensive survey recording the approximate volume of timber killed over a period of years. Though this method is not entirely satisfactory and subject to some criticism, it is believed to be the only fair way of determining the actual results obtained from control measures which are maintained over a period of years. There-

fore this method will be followed in analyzing the results obtained on the Independence Creek Project.

RESULTS OF INDEPENDENCE CREEK CONTROL WORK

From Table No. 1 on page 4 it will be seen that the average annual loss from 1918 to 1923 inclusive, for the Independence Creek Control area amounted to 51,453 B. F. From Chart #1 it will be noted that during these six years the cycle included two low points and only one high one which would make the above figure a trifle low. If the average be taken of the losses which occurred during the four year's cycle then an annual loss of 59,220 B. F. would be secured. However, the first figure will be used in analyzing the results obtained from this project though it is sincerely believed to be low.

From Table No. 6 on page 13 it will be seen that the difference between the volume of timber killed following the 1924 operation and the annual loss for the area, amounted to 32,473 B. F., and 45,618 B. F. for the 1925. Taking the total expenditure of the project the timber saved following the 1924 and 1925 control operations cost $7.85 and $3.17 respectively, or an average of $5.12 for the two years. It is deeply regretted that the results of the 1925 operation were lost by the closing of the experiment due to the area being burned. However the writer sincerely believes that at least the low point gained by the 1925 operation would have been maintained at no greater cost than was required to treat this volume

Table No. 6

Table Showing the Results Obtained from the 1924 and 1925 Control Operation, and the Cost of the Volume Saved.

Year of Attack	Volume Killed	Decrease Over Previous Year's Loss.	Year Treated	Cost of Control Work	Volume Saved B. F. (x)	Cost per M. B. F. Saved	Total Volume Saved B. F.	Cost per Total M. B. F. Saved.	Cost of Protection for Entire Area. Per Acre	Per Total M. B. F. Volume in area. M.B.F.
1923	46,700	-----	1924	254.89	32,473	$7.85	32,473	$7.85	.0727	.0299
1924	18,980	-.6102	1925	144.93	45,618	$3.17	78,091	$5.12	.0414	.0170
1925	5,835	-.6925	1926	128.57	45,618	$2.82	123,709	$4.27	.0367	.015
(xx)										
1926	5,835	- 0	1927	128.57	45,618	$2.82	169,327	$3.88	.0367	.015
1927	5,835	- 0	1928	128.57	45,618	$2.82	214,945	$3.65	.0367	.015
				$785.53	214,945					

(x) Volume saved is secured by deducting the volume of the current year's loss from the average annual loss of 51,453 B. F.

(xx) Data below this line are assumed on the basis that the infestation could have been held at the low point resulting from the 1925 control operation at the same cost as was required to treat this volume in 1926.

in 1926. If we should assume this to be true then as a result of the 1926 control work the saving of the 45,618 B. F. would have only cost $2.82 or an average of $4.27 for the three years. If we should carry this assumption forward on the same basis for another two years, which was supposed to be the life of the project, a saving of 214,945 B. F. would have been secured at a total cost of $1,785.53 or $8.65 per thousand B. F. However, these data are but assumptions and though the writer believes in their fairness it will be necessary to use the results of the 1924 and 1925 operation only, which show a saving of 78,091 B. F. at a cost of $5.12 per thousand.

JUSTIFICATION OF EXPENDITURES FOR CONTROL.

The justification of this expense would seem to depend entirely upon the stumpage value of the timber in question at the time the control work was conducted. This premise was also taken by Mr. J. M. Miller in his report of the San Joaquin Experimental Control Project, California, under date of November 20th, 1924, as he states that it would have been necessary for the timber saved to have had a stumpage value equal to the total cost of saving it in order to justify maintenance control in yellow pine. The writer feels that the stumpage value must be sufficiently in excess of the cost of saving that a fair rate of interest on what must be considered as a new investment can be secured.

It is believed that forest insect control work should be con-

sidered as a matter of salvage and not as a question of insurance on the original investment. If one realizes that a certain volume of their timber is going to be destroyed each year by insects, then in such a realization the loss of their original investment, interest, taxes, carrying charges, etc., on this volume, must be accepted. Therefore if by the expenditure of a certain sum of money for control work this volume of timber, which would otherwise have been lost, can be saved, it should be considered as a matter of salvage or an entirely new investment. The return which would be expected on such an investment would lie in the margin between the cost of salvage and the market price of the material saved. The loss of the original purchase price, carrying charges, etc., of a certain volume of timber, accompanies the need for its salvage. Therefore, the only charge which can properly be made against the margin of profit which lies between the cost of salvage and the market price of the material saved, is a fair rate of interest on the expenditure. Furthermore, a certain part of this rate of interest would be provided for in the increased increment of the timber saved. No consideration need be given to future carrying charges of the timber saved, as the expense for fire patrol, taxes, administration, etc., would undoubtedly be the same regardless of the volume salvaged.

The writer is advised that the present stumpage value of white pine within the Coeur d'Alene National Forest averages from $8.00 to $9.00 per M.B.F. Based upon the above stumpage values it would seem that an expenditure of $5.12 in order to save a M.B.F. of white pine valued at $8.50 would be justified. This margin

or $3.38, would seem to be an adequate profit on the investment and one which would support a fair rate of interest for several years.

Realizing that regardless of the amount of infestation which is treated within an area there will be a certain minimum cost per acre for protection below which it will be impossible to reduce the expenditure. Therefore there may be areas on which the average annual loss from the normal or endemic infestation will be so low that the volume of timber saved from even an 85 percent reduction would not be sufficient to justify the expenditure. During the 3 years of control work on the Independence Creek area the average cost per acre amounted to approximately 5¢. It is sincerely believed that over a period of years this charge could be reduced to at least ¼¢ and possibly lower. However, we will again be obliged to use the actual data which we have in analysing this problem, or a cost of 5¢ per acre. If we grant that in 3 years a reduction of even 75 percent from the annual loss can be made and maintained it would only be necessary for the average annual loss on an area to be from 6 to 7 M. B. F. per section in order to justify the cost of control which would amount to $32.00 per section or 5¢ per acre. This figure is based upon a stumpage value of $5.50 per M. B. F. and an acreage cost of control amounting to 5¢, which would have been reduced had the project continued. At an annual loss of 6 to 7 M. B. F. per section an allowance is made for a certain percent of the infestation being missed by control work.

SUMMARY

In summarizing the very limited data obtained from the Independence Creek Experimental Control Project it is evident:

I. That the losses resulting from a normal or endemic infestation were materially reduced and that in 2 years a reduction of 88 percent from the average loss within the area was made.

II. That as a result of the 1924 and 1925 control operations, 78,091 M. B. F. of white pine timber were saved.

III. That the cost of saving this timber amounted to $5.12 per M. B. F. for the 2 years.

IV. That the average value of white pine stumpage on the Coeur d'Alene National Forest being approximately $8.50 there would be a margin of $3.38 over the cost of salvage.

V. That the stumpage value of the timber in question would be the controlling factor in the justification of this expense.

VI. That the stumpage value of the timber saved should permit of a profit over the cost of control adequate to provide a fair rate of interest on the expenditure for salvage.

VII. That the average cost of maintenance control used in reducing an endemic or normal infestation of the mountain pine beetle in white pine would be approximately 5¢ per acre.

VIII. That an area with an infestation as light as 6 to 7 M. B. F. per section would seem to justify maintenance control.

CONCLUSIONS.

The writer wishes to again stress the fact that the deductions as made within this report are based upon two years data only. It is fully realized that the data available are by far too meager to permit of final conclusions of this problem.

Though these facts are fully appreciated this report has been prepared for the purpose of presenting the results as shown by the data secured regardless of the fact that they cannot be accepted as conclusive. Furthermore the progress which has been made in this becomes available in future considerations of this problem. It is trusted that in the near future another attack can be made upon this problem as it is believed to be one of the most important forest insect problems within this District at this time.

Respectfully Submitted,

James C. Evenden
Associate Entomologist.

CHART #1

This graph shows the volume of timber killed on the Independence Creek experimental areas for the different years that this infestation was followed. As stated in the text of this report it is possible that the 1918 loss is a trifle low due to the fact that 1918's attack was not recorded until 1920. Control work started in this area during the season of 1924 with the treatment of the 1923 attacks and was continued during the season of 1925 and 1926.

CHART #1

VOLUME OF WHITE PINE

KILLED BY THE MOUNTAIN PINE BEETLE

ON THE INDEPENDENCE CREEK EXPERIMENTAL AREA.

CHART #2

This graph shows the relation which an infestation on the Cascade Creek Drainage, Coeur d'Alene Forest, bears to the Independence Creek infestation. The Cascade Creek Drainage is from 10 to 12 miles south of Independence Creek and contained the same character of infestation. During the years that the infestation in these 2 areas was followed the average loss per acre amounted to 14.1 B.F. at Cascade Creek and 14.7 B.F. for Independence Creek. It will be seen that the two infestations followed each other very closely until the institution of control measures in the Independence Creek area.

CHART # 2

SHOWING THE COURSE OF THE

MOUNTAIN PINE BEETLE INFESTATION IN

THE INDEPENDENCE AND CASCADE CREEK DRAINAGES

COEUR D'ALENE NATIONAL FOREST.

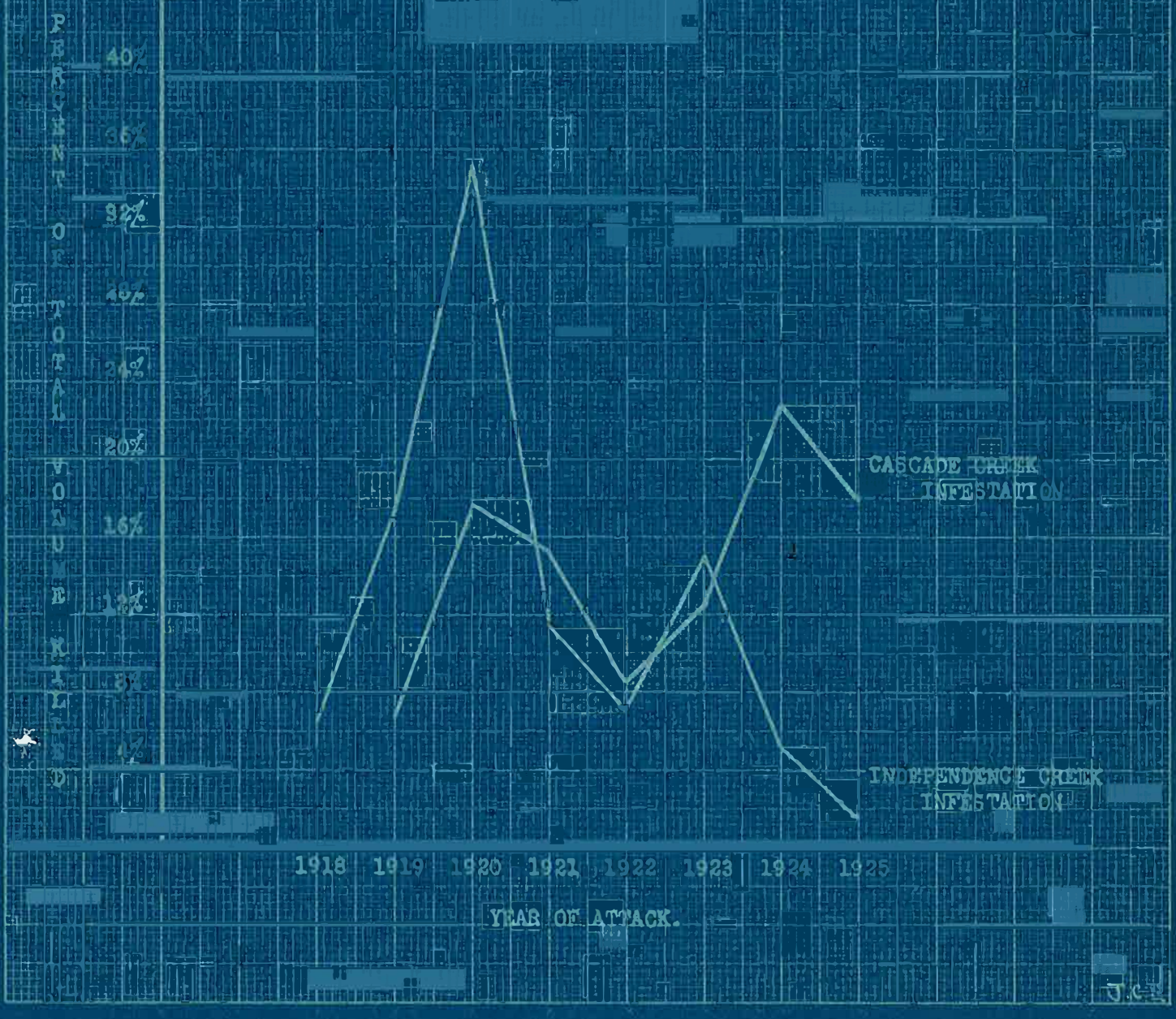


CHART #3

This chart shows the relation between the rate of growth of green and insect killed trees. The curves were based upon the average number of rings for each diameter. Though in a few cases the insect killed trees showed a faster growth than the green ones for the most part the available data showed them to be slower growing. However, sufficient data is not available upon which to base definite conclusions.

CHART # 3

SHOWING A COMPARISON OF THE RATE OF GROWTH BETWEEN INSECT KILLED AND GREEN TREES ON THE INDEPENDENCE CREEK AREA BASED UPON 223 GREEN AND 50 INSECT KILLED TREES. SHOWING THE AVERAGE NUMBER OF RINGS FOR EACH DIAMETER.

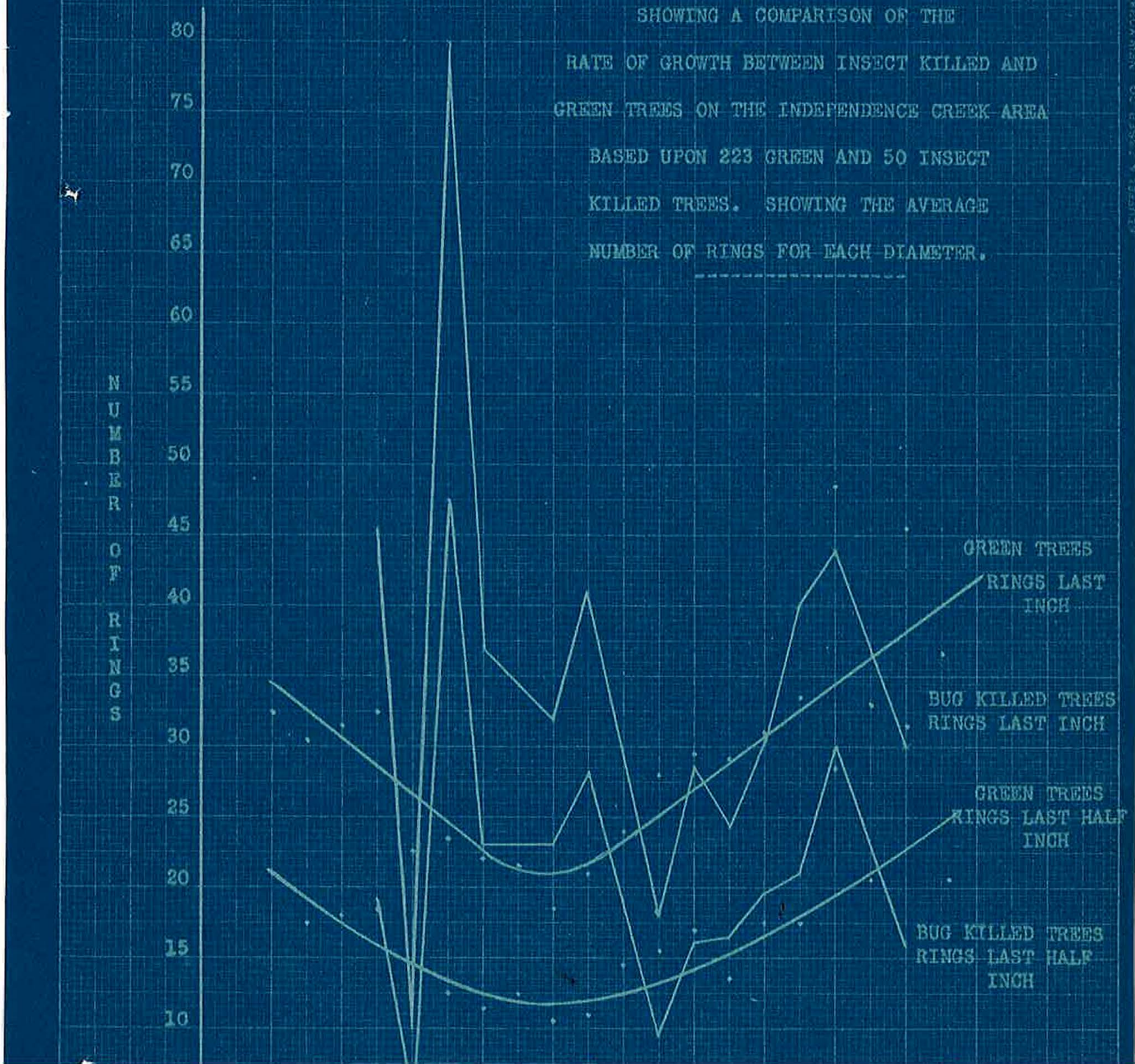


CHART #4

This graph shows the relation of different exposures to the trees killed on the Independence Creek area during the time this infestation was followed. Though it is believed that there may possibly be a relation between such factors as exposure, elevation, site, etc., and insect attack sufficient data is not available in which to base definite conclusions.

CHART # 4

EXPOSURE OF THE WHITE PINE TREES KILLED BY THE MOUNTAIN PINE BEETLE ON THE INDEPENDENCE CREEK EXPERIMENTAL AREA 1918 - 1925 INCLUSIVE

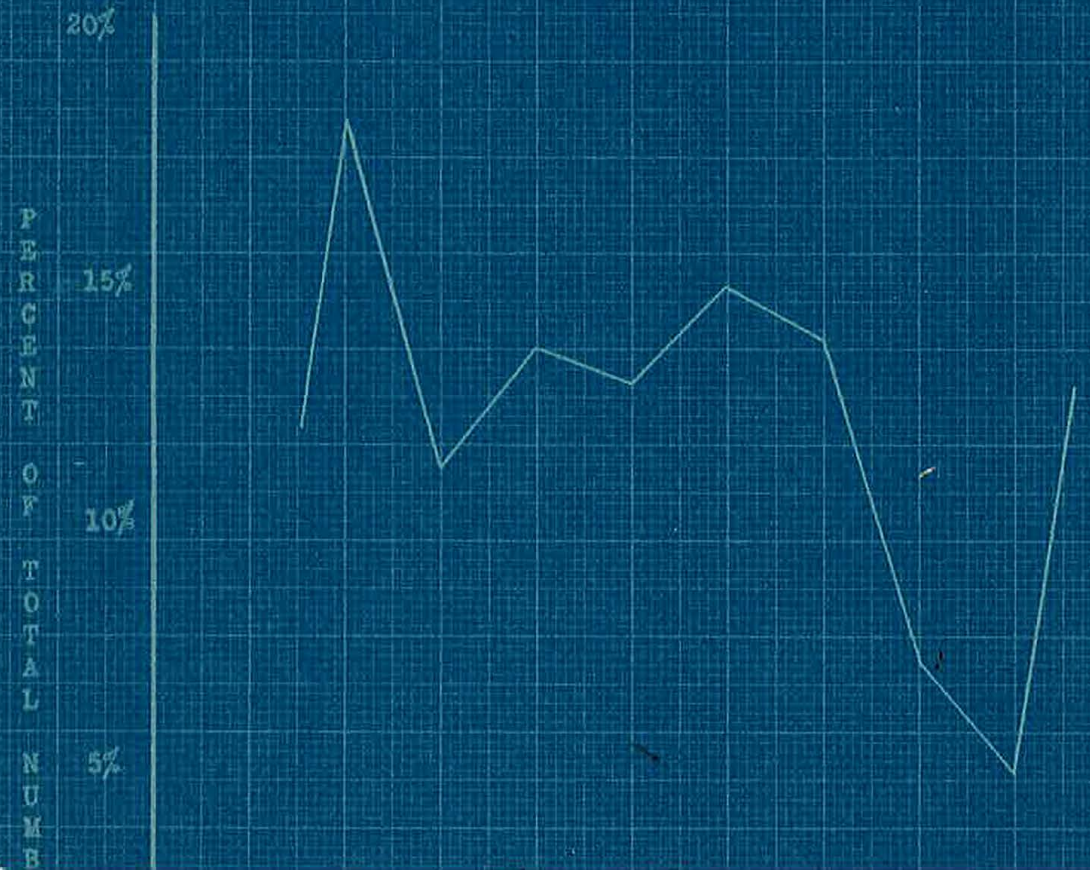


CHART #1

This graph shows the volume of timber killed on the Independence Creek experimental areas for the different years that this infestation was followed. As stated in the text of this report it is possible that the 1918 loss is a trifle low due to the fact that 1918's attack was not recorded until 1920. Control work started in this area during the season of 1924 with the treatment of the 1923 attacks and was continued during the season of 1925 and 1926.

CHART #1

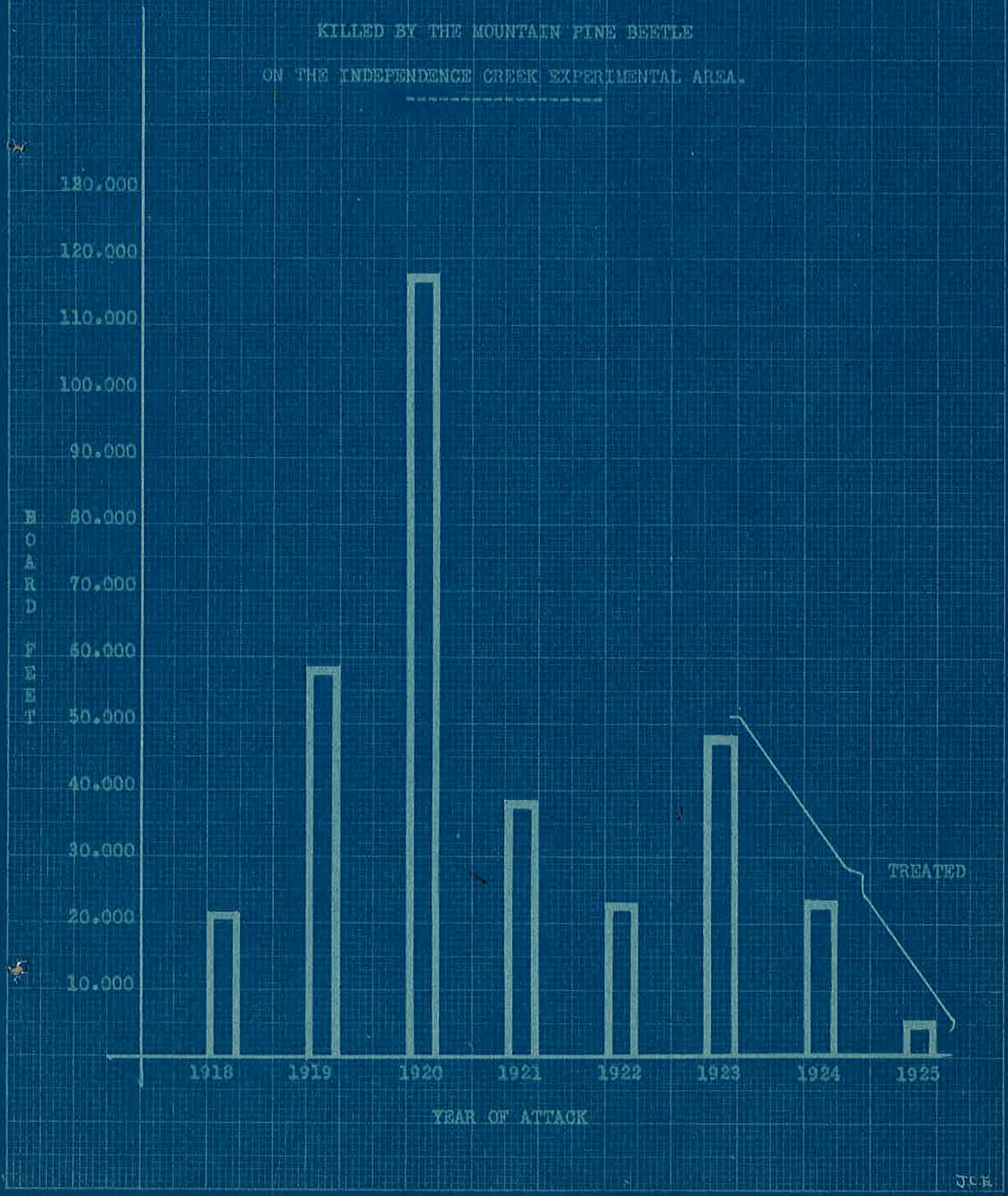
VOLUME OF WHITE PINE
KILLED BY THE MOUNTAIN PINE BEETLE
ON THE INDEPENDENCE CREEK EXPERIMENTAL AREA.

CHART #1

VOLUME OF WHITE PINE

KILLED BY THE MOUNTAIN PINE BEETLE

ON THE INDEPENDENCE CREEK EXPERIMENTAL AREA.



J.C.K.

CHART #2

This graph shows the relation which an infestation on the Cascade Creek Drainage, Coeur d'Alene Forest, bears to the Independence Creek infestation. The Cascade Creek Drainage is from 10 to 12 miles south of Independence Creek and contained the same character of infestation. During the years that the infestation in these 2 areas was followed the average loss per acre amounted to 14.1 B.F. at Cascade Creek and 14.7 B.F. for Independence Creek. It will be seen that the two infestations followed each other very closely until the institution of control measures in the Independence Creek area.

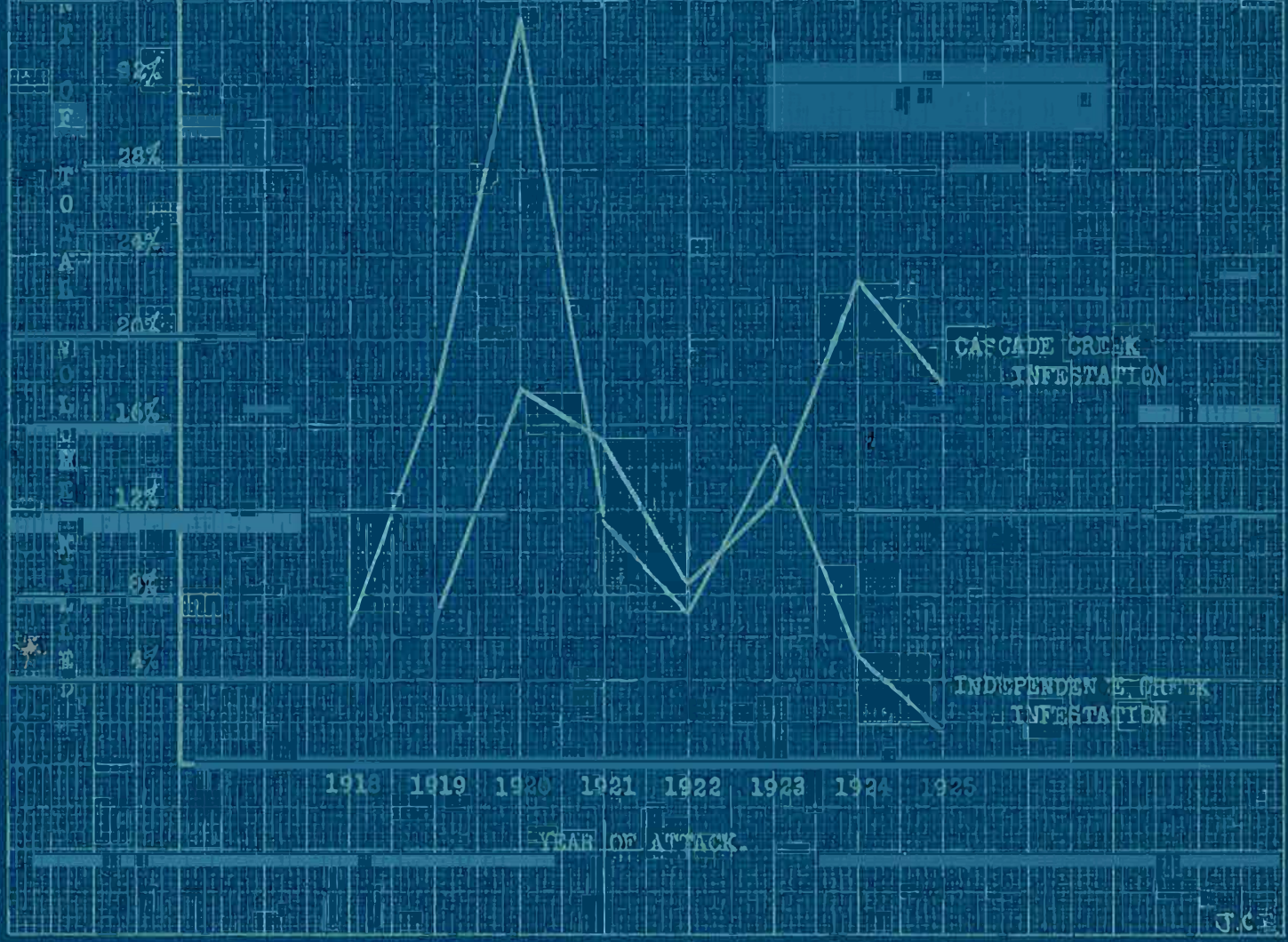
CHART # 2

SHOWING THE COURSE OF THE

MOUNTAIN PINE BEETLE INFESTATION IN

THE INDEPENDENCE AND CASCADE CREEK DRAINAGES

COEUR D'ALENE NATIONAL FOREST.



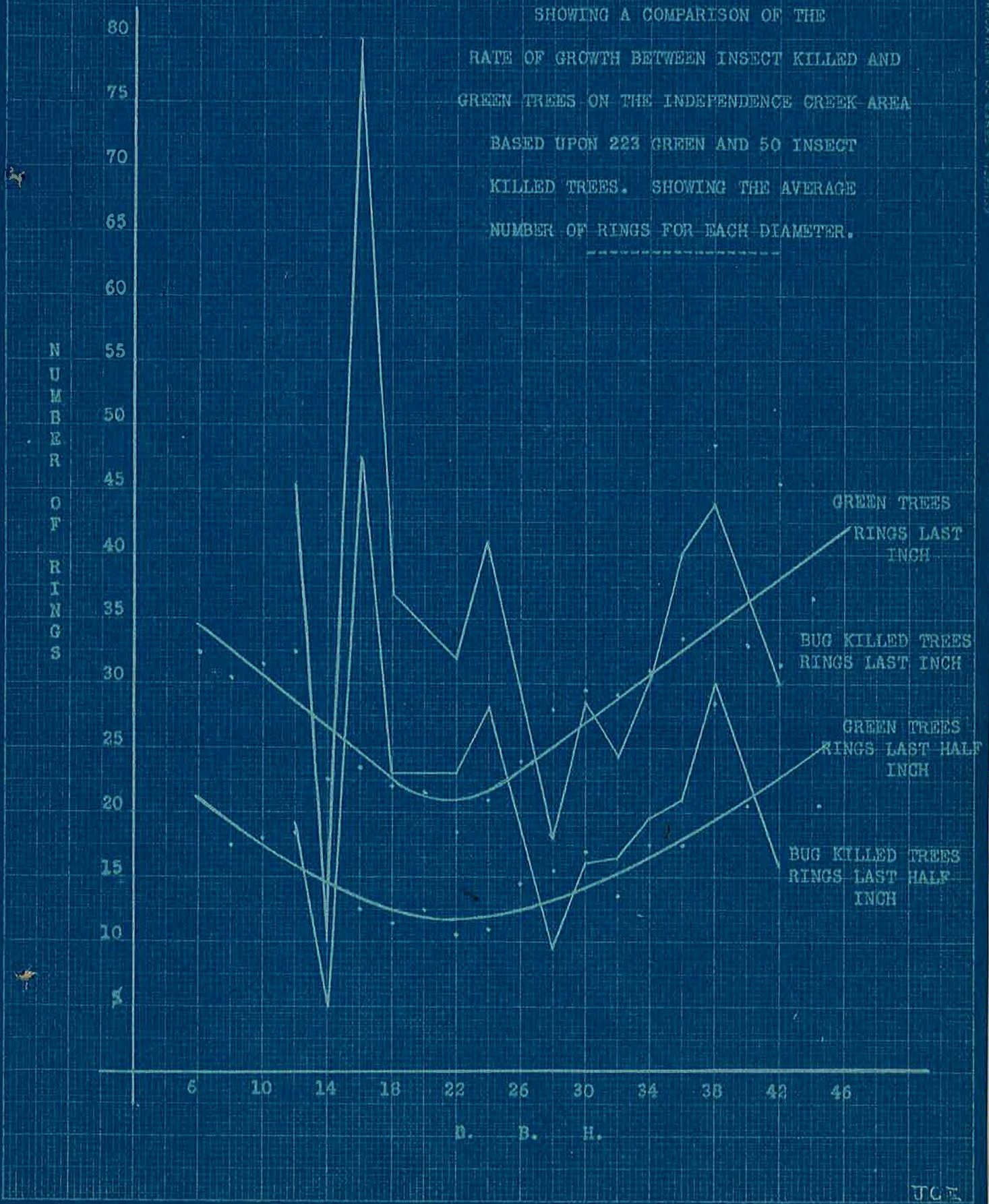
J.C.B.

CHART #3

This chart shows the relation between the rate of growth of green and insect killed trees. The curves were based upon the average number of rings for each diameter. Though in a few cases the insect killed trees showed a faster growth than the green ones for the most part the available data showed them to be slower growing. However, sufficient data is not available upon which to base definite conclusions.

CHART # 3

SHOWING A COMPARISON OF THE RATE OF GROWTH BETWEEN INSECT KILLED AND GREEN TREES ON THE INDEPENDENCE CREEK AREA BASED UPON 223 GREEN AND 50 INSECT KILLED TREES. SHOWING THE AVERAGE NUMBER OF RINGS FOR EACH DIAMETER.



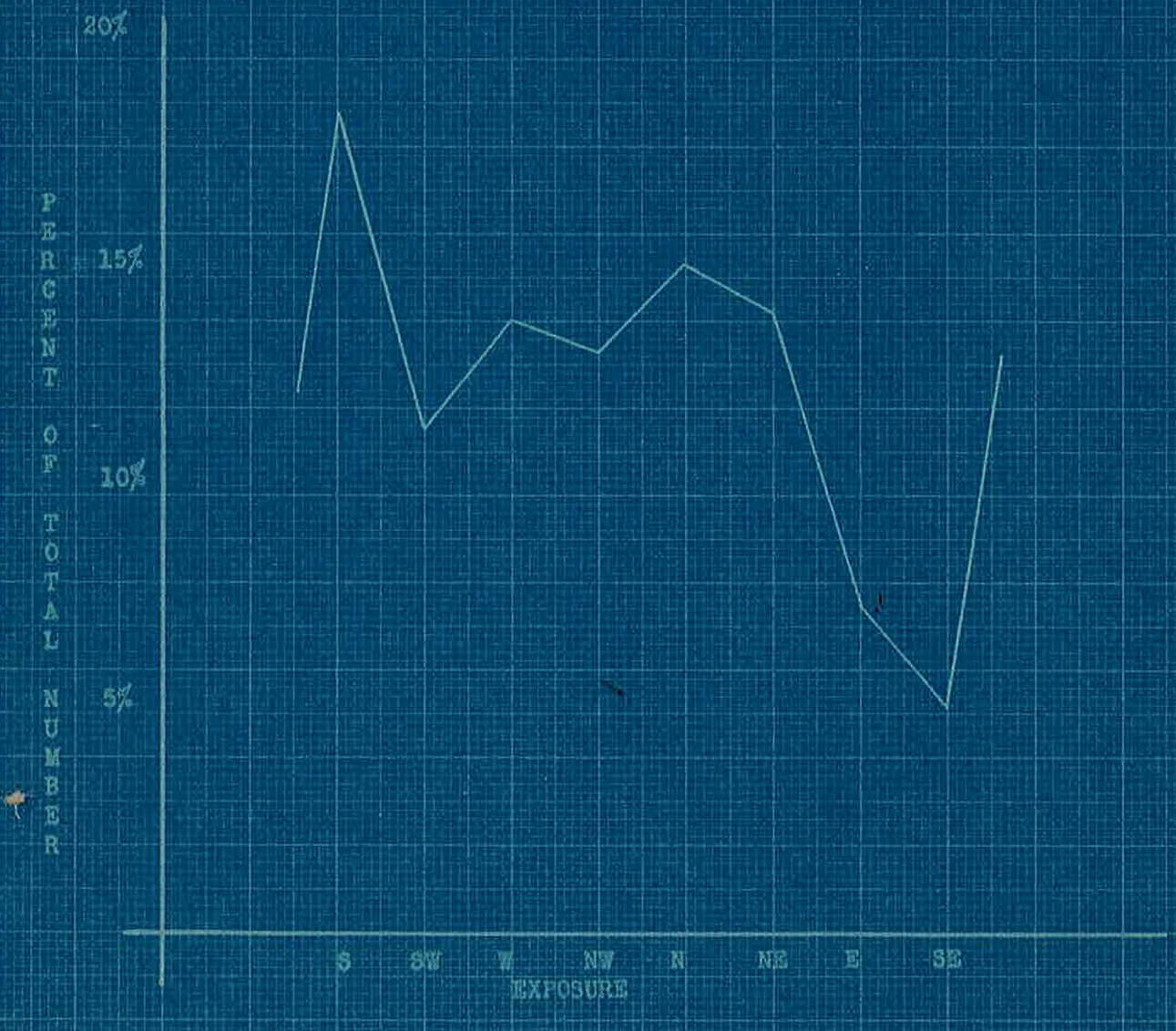
JCE

CHART #4

This graph shows the relation of different exposures to the trees killed on the Independence Creek area during the time this infestation was followed. Though it is believed that there may possibly be a relation between such factors as exposure, elevation, site, etc., and insect attack sufficient data is not available in which to base definite conclusions.

CHART # 4

EXPOSURE OF THE WHITE PINE TREES KILLED BY THE MOUNTAIN PINE BEETLE ON THE INDEPENDENCE CREEK EXPERIMENTAL AREA 1918 - 1925 INCLUSIVE



JCE